IDEM=s Surface Water Quality Assessment Program

Indiana's Participation in the National Study of Chemical Residues in Lake Fish Tissue

(U.S. EPA Office of Science and Technology)

Background and Project Description

The U.S. Environmental Protection Agency (U.S. EPA) Office of Water conducted a national screening-level investigation in 1987 to determine the prevalence of selected bioaccumulative pollutants in fish and to correlate elevated fish tissue contaminant levels with pollutant sources. Gamefish and bottom-dwelling fishes were collected from 314 locations across the country thought to be influenced by various point and nonpoint sources. These fish tissue samples were analyzed to determine levels of 60 target analytes, including dioxins and furans, PCBs, pesticides, mercury, and several other organic compounds. Results of the 1987 study indicated that target analytes were present in fish tissue at many of the sampling sites and some of the contaminants (e.g., PCBs, dieldrin, mirex, and combined chlordane) occurred at levels posing potential human health risks.

The Office of Water has initiated work on a new four-year national study of chemical residues in fish tissue, which is designed to expand the scope of the 1987 study. This contemporary study is statistically designed and will provide screening-level data on fish tissue contaminants from a greater number of waterbodies than were sampled in 1987.

This study broadens the scope of the 1987 study, which focused on chemical residues in fish tissue near point source discharges. The new study will:

- Provide information on the national distribution of selected **persistent, bioaccumulative, and toxic (PBT)** chemical residues in gamefish and bottom-dwelling fish in lakes and reservoirs of the coterminous United States (excluding the Great Lakes),

- Include lakes and reservoirs selected according to a probability design,

- Involve the collection of fish from those randomly selected lakes and reservoirs over a four-year survey period (2000-2003),

- Not be used to set fish consumption advisories; however, states and Native American Tribes may choose to initiate a detailed fish study in a particular lake based on the screening contaminant concentrations provided by the national study, and

- Include the analysis of fish tissue for PBT chemicals selected from U.S. EPA's multimedia candidate PBT list of 451 chemicals and from a list of 130 chemicals from several contemporary fish and bioaccumulation studies. A final target analyte list of 87 PBT chemicals was compiled

based on input from study design workshop participants and a review team of analytical experts convened in October 1998 and March 1999, respectively.

Lakes and reservoirs were chosen as the target population because they:

- Are accumulative environments where contamination is detectable,
- Provide important sport fisheries nationwide,
- Offer other recreational (nonfishing) access and opportunities, and
- Occur in agricultural, urban, and less-developed areas, so that associations with each primary use may be determined.

Lakes and reservoirs are the focus of this study rather than other waterbody types because:

- Fish consumption advisories represent 16.5% of the Nation's total lake acres (plus 100% of the Great Lakes), compared to 8.2% of the Nation's total river miles (USEPA 1998b). [**Note:** The Great Lakes is not included in this study because substantial fish tissue contaminant information is available and continues to be collected in ongoing Great Lakes monitoring programs.]
- Estuaries are currently being studied by U.S. EPA's Environmental Monitoring and Assessment Program (EMAP). EMAP has sampled fish from East and Gulf Coast estuaries, and will include fish contamination in its Year 2000 initiative on West Coast estuaries.

The specific objective of the new National Fish Tissue Study is to ***estimate the national distribution of the mean levels of selected persistent, bioaccumulative, and toxic chemical residues in fish tissue from lakes and reservoirs of the coterminous United States.***

In so doing, the study will provide the following types of information:

- Information to meet objectives of the President's Clean Water Action Plan (CWAP) and to specifically respond to the following action item:

  > *CWAP Key Action: USEPA and NOAA will conduct a national survey of mercury and other contaminants in fish and shellfish throughout the country, and will coordinate the effort with states and tribes to maximize geographic coverage. The shellfish survey will be based on the data obtained by NOAA's ongoing Mussel Watch Project.*

- Information about persistent, bioaccumulative, and toxic chemicals (PBTs) for the U.S. EPA's PBT Initiative that addresses the following objective:

  > *The PBT Initiative seeks to identify areas of concern for human and/or ecological health. Study of fish tissue may reveal where PBTs not previously considered a problem are present at levels of concern.*

- Data to answer important questions concerning the regional occurrence of fish tissue contamination, such as the following:

  What is the national extent of selected chemical contaminants in fish from lakes of the coterminous United States (excluding the Great Lakes)?

  What chemical residues are found in fish from lakes located in agricultural and nonagricultural areas of the United States?

  Are contaminant levels in fish high enough to warrant further investigation?

What are the benefits to the State of Indiana, IDEM and tie-in to ongoing programs?

The Biological Studies Section in the Office of Water Quality (IDEM) is the primary collector and curator of data that supports the Indiana Fish Consumption Advisory (FCA) issued by the Indiana State Department of Health. Results from this National Lakes Fish Contaminants study will directly benefit our efforts to further contribute data in support of the FCA. The Biological Studies Section has over 24 years of experience toward understanding biological tissue contamination, bioaccumulation of potentially toxic compounds and risks to humans and wildlife from consumption of fish containing contaminants.

The Office of Water Quality (OWQ) Assessment Branch is responsible for assessing the quality of Indiana's surface waters. This includes obtaining data on, and furthering our knowledge on the fate of bioaccumulating contaminants in the biota that occupy Indiana waterbodies. Information from this National study will also aid our efforts to develop indicators of environmental successes and failures through long term trend monitoring based on a scientifically sound sampling design in support of EnPPA goals (for example mercury reduction programs).

Where will we be sampling?

The national study has stratified the selection of lakes to be sampled into 6 size classes. The selection of lakes has also been stratified by region of the country.

Number of lakes selected for sampling by size category and year for coterminous United States.

Lake area (ha)	2000	2001	2002	2003	All Years	Weighting Factor
>1-5	39	41	47	47	174	938.84
>5-10	44	40	47	46	177	261.61
>10-50	32	47	46	25	150	256.51
>50-500	34	37	29	34	134	85.06
>500-5000	36	30	31	41	138	11.36
>5000	40	30	25	32	127	2.21
Total	**225**	**225**	**225**	**225**	**900**	

For Indiana, eleven lakes were originally selected by the stratified random design for sampling over the four years of the project. The following table lists all of the lakes chosen for the study that were located in Indiana. Several of these were later determined to be nontarget or unacceptable for sampling given the criteria that U.S. EPA listed for inclusion/exclusion of a waterbody. The U.S. EPA River Reach File 3

(RF 3) was used to generate the random list of lakes. The RF3 provided the best known Geographical Information System (GIS) coverage for lakes.

Randomly Selected# List of Target Lakes.

Lake Name	County	Lake Area (ha)	Year	Completed?	Latitude			Longitude		
					Deg	Min	Sec	Deg	Min	Sec
Baire Lake	Putnam	3	2000	2000	39	43	58.8	-86	45	17.6
Unnamed	Huntington	102	2000	Nontarget*	40	43	47.3	-85	33	10.8
Unnamed	Brown	59	2000	Nontarget*	39	5	58.6	-86	19	34.3
Winona Lake	Kosciusko	216	2001	2001	41	13	22.4	-85	50	1.0
Turtle Creek Reservoir	Sullivan	606	2001	2001	39	4	1.9	-87	31	43.0
Geist Reservoir	Hamilton	683	2001	2001	39	55	41.5	-85	56	33.0
Round Lake	Greene	8	2002	Nontarget*	39	2	6.0	-87	14	6.7
Hardy Lake	Scott	316	2002	2002	38	46	21.4	-85	41	20.0
Gravel pit	St. Joseph	18	2003	Nontarget	41	36	40.3	-86	20	17.5
Fox Lake	Steuben	53	2003	2003	41	37	36.5	-85	1	25.0
Sportsmens Club	Montgomery	5	2003	2003	40	2	5.6	-86	57	10.8

#=Waterbodies were selected by a randomized design utilizing U.S. EPA Reach File 3. The inclusion probability was determined by the goal of obtaining approximately an equal number of lakes to sample in each size category.

Nontarget*=Waterbody did not meet U.S. EPA criteria for sampling.

What will we be sampling?

Two distinct trophic groups of fish, bottom-dwellers and predators, will be included as target fishes for this study. This permits monitoring of a wide variety of habitats, feeding strategies, and physiological factors that might result in differences in bioaccumulation of contaminants. Suggested target species are listed in the following table in order of preference. IDEM staff will make an effort to collect one composite sample containing five individual whole fish for each of these categories. Every effort will be made to collect the desired species and number of fish; however, the outcome of field sampling efforts will ultimately depend on the natural diversity and abundance of fish in the study lakes.

What are we analyzing for?

An analytical methods workgroup selected 87 target analytes for analysis. These include compounds found in the following groups:

- Organohalide pesticides
- Organophosphorus pesticides
- Dioxins/furans
- Toxic PCBs
- Hydrocarbons, Phenols
- PAHs
- Total mercury
- Arsenic

Recommended Target Species for Inland Freshwaters (Presented in Order of Preference).

	Family name	Common name	Scientific name
Predator Species *(in order of preference)*	*Centrarchidae*	Largemouth bass	***Micropterus salmoides***
		Smallmouth bass	***Micropterus dolomieu***
		Black crappie	***Pomoxis nigromaculatus***
		White crappie	***Pomoxis annularis***
	Percidae	Walleye	***Stizostedion vitreum***
		Yellow perch	***Perca flavescens***
	Percichthyidae	White bass	***Morone chrysops***
	Esocidae	Northern pike	***Esox lucius***
	Salmonidae	Lake trout	***Salvelinus namaycush***
		Brown trout	***Salmo trutta***
		Rainbow trout	***Oncorhynchus mykiss***
		Brook trout	***Salvelinus fontinalis***
Bottom-dwelling Species *(in order of preference)*	***Cyprinidae***	Common carp	***Cyprinus carpio***
	Ictaluridae	Channel catfish	***Ictalurus punctatus***
		Blue catfish	***Ictalurus furcatus***
		Brown bullhead	***Ameiurus nebulosus***
		Yellow bullhead	***Ameiurus natalis***
	Catostomidae	White sucker	***Catostomus commersoni***

Information Contacts

James R. Stahl, Senior Environmental Manager
Indiana Department of Environmental Management
Office of Water Quality – Assessment Branch
Biological Studies Section
P.O. Box 601- Shadeland
Indianapolis, IN 46206-6015
(317) 308-3187
fax (317) 308-3219
E-mail: *jstahl@dem.state.in.us*

Carol Newhouse, Senior Environmental Manager
Indiana Department of Environmental Management
Office of Water Quality – Assessment Branch
Biological Studies Section
P.O. Box 6015 - Shadeland
Indianapolis, IN 46206-6015
(317) 308-3217
fax (317) 308-3219
E-mail: cnewhous@dem.state.in.us

	For More Information on IDEM's Office of Quality…
IDEM Information: (317) 233-1044 or 800-451-6027 800-743-3333(TDD) toll-free for Indiana residents **EnviroLine:** (317) 232-8603 or 800-451-6027 toll-free for Indiana residents **Fax on Demand:** 800-726-8000 **Internet:** *www.state.in.us/idem*	**Assessment Branch** (Surface water quality: river, streams and lakes) Shadeland Office, Indianapolis (317) 308-3173 **Permitting Branch** (NPDES permits) Indiana Government Center North, Indianapolis (317) 232-8675 **Compliance Branch** (facilities assistance, inspections and compliance) Indiana Government Center North, Indianapolis (317) 232-6770 **Drinking Water Branch** (Public water supply and ground water protection) Shadeland Office, Indianapolis (317) 308-3280 **Planning & Restoration Branch** (Water quality standards/rules, grants and loans, watershed management) Indiana Government Center North, Indianapolis (317) 233-8488